BY ORDER OF THE
SECRETARY OF THE AIR FORCE

AIR FORCE OCCUPATIONAL SAFETY AND
HEALTH STANDARD 91-68

1 OCTOBER 1997

Safety

CHEMICAL SAFETY

OPR: HQ AFSC/SEGS
(SMSgt Pennie Hardesty)
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(Col Robert W. Scott)
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The criteria in this standard are the Air Force's minimum safety, fire prevention, and occupational health requirements. Major commands (MAJCOM), direct reporting units (DRU), and field operating agencies (FOA) may supplement this standard when additional or more stringent safety, fire prevention, and health criteria are required. Refer to Air Force Instruction 91-301, *Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Program*, for instructions on processing supplements or variances. Report conflicts in guidance between this standard, federal standards, or other Air Force directives through MAJCOM, DRU, or FOA ground safety offices to Headquarters Air Force Safety Center, Ground Safety Division, Safety Engineering and Standards Branch (HQ AFSC/SEGS), 9700 Avenue G, SE, Kirtland AFB, NM 87117-5670.

This standard applies to all US Air Force Reserve personnel and when Air National Guard personnel are on federal service. It addresses US Air Force chemical storage, handling, use, and disposal operations. It was developed for the first level supervisor and provides that individual with some fundamental chemical safety principles designed to assist in identifying potential hazards and suggests sources of help to evaluate and control these hazards. Refer to the text and to **Attachment 1** for identification of these sources. The standard is not intended to make supervisors "instant experts" but rather is designed to sensitize them to basic concerns. With the proper appreciation of chemical hazards and adherence to their controls, chemicals can be used safely in Air Force operations.

SUMMARY OF REVISIONS

Administrative changes have been made to update this standard to electronic format. Paragraphs have been renumbered and references updated. A glossary of references, abbreviations, acronyms, and terms is provided at **Attachment 1**. A | indicates revisions from the previous edition.

NOTE: AFOSH 127-series standards are being converted to 91-series standards and the 161-series to 48-series standards. However, not all standards have been converted as of the effective date of this standard. To help you locate these documents, references to AFOSH standards are stated in the updated series and standard number, with the outgoing series and standard number stated as "formerly designated as" in the 'references' section of **Attachment 1**.

Chapter 1

HAZARDS AND HUMAN FACTORS

1.1. Toxic and Physical Hazards. The hazards of chemicals can be broadly divided into two categories: Toxic hazards of chemicals (toxic effects) can be either long term (chronic) or short term (acute), or both. For example, benzene is a chemical which, over a long period of time at low concentrations in the air, may cause cancer. Benzene is also acutely toxic if breathed in high concentrations over a short period of time. Physical hazards of chemicals include heat effects or pressure ruptures due to reaction of chemical materials. For example, waste solvents could react vigorously with acids causing waste containers to violently burst-- a good example of a physical hazard. These toxic and physical hazards may be found in the US Air Force workplace or in the off-duty environment if carelessly released. Chemicals are found in virtually every US Air Force operation including aircraft and missile maintenance, civil engineering, transportation, supply, medical, and support functions. Some common examples are sodium hypochlorite (bleach) used in sewage treatment plants, laundry, and swimming pools; ammonium hydroxide used in some reproduction machines; and PD-680 (dry cleaning fluid) used as a degreaser. Hazards presented by chemical operations include burns, toxicity, fire, explosion, and skin irritation.

Chapter 2

GENERAL REQUIREMENTS

2.1. Federal Safety Standards. There are several series of Federal safety standards that address chemical safety. Occupational Safety and Health Administration (OSHA) Standard 29 Code of Federal Regulations (CFR) 1910, Subpart H covers Hazardous Materials; Subpart Z covers Toxic and Hazardous Substances. The Department of Transportation (DOT) also has published extensive information regulating the shipment of chemicals by air, rail, ship, and water carriers, in particular, 49 CFR Subchapter C, Parts 170 through 177, *Hazardous Materials Regulations*. In addition, the Environmental Protection Agency (EPA) has published standards regulating the disposal of toxic chemicals, in particular, 40 CFR Subchapter D, parts 100-149, Subchapter E, parts 162-180, and Subchapter N, parts 400-775.

2.2. Department of Transportation (DOT) Hazard Classes. Many common chemicals are categorized into hazard classes for transportation purposes by 49 CFR Subchapter B. Each of the major hazard classes is listed and described in **Attachment 2**. Also included are general hazards and effects of the chemicals in each class and a generalized list of engineering controls and personal protective equipment (PPE) for safe use of these chemicals.

2.3. National Fire Protection Association (NFPA) Hazard Classes. Chemicals are also categorized by health, flammability, and reactivity hazards by NFPA 49, *Hazardous Chemicals Data*. See Attachment 3 for an explanation of this system. This system was designed to inform firefighters of potential hazards during a fire and are not necessarily the same hazards encountered during normal use of these chemicals.

2.4. Guide to Compatibility of Chemicals. Attachment 4 provides supervisors with a starting point in identifying hazards associated with intermixing of chemicals during storage or handling. It is not all-encompassing and is not intended to task the supervisor with evaluating the risks involved in handling these chemicals. Using the table in conjunction with paragraph **3.3.** will alert the supervisor to the need to contact the Bioenvironmental Engineer (BEE) for further evaluation. Not all chemicals used in the Air Force go by their proper chemical names and, therefore, may not be listed. Also, these chemicals are classed according to their predominant hazard, which may not be the only hazard associated with the chemical. For example, perchloric acid is classed as an oxidizer, but is also corrosive and poisonous. Thorium is classed as radioactive material, but can also be a flammable solid, if finely divided.

2.5. Material Safety Data Sheets (MSDS). The BEE maintains a comprehensive Hazardous Materials Information System (HMIS) and manufacturer's MSDS providing product hazard information for the supervisor as well as safety and health specialists or technicians and managers.

Chapter 3

SPECIFIC REQUIREMENTS

3.1. Ordering. All chemical materials shall be ordered through normal supply channels. The BEE will be consulted prior to ordering chemicals that have not previously been used in the shop. Supervisors are cautioned against borrowing unfamiliar chemicals from other operations without BEE coordination. (The BEE will determine the need for coordination with the Base Environmental Coordinator (BEC) in Civil Engineering.) Seemingly simple but unauthorized substitutions can result in disastrous consequences.

3.2. Transportation. All commercial carrier transportation of hazardous chemicals are required to comply with Title 49 CFR requirements. Air transportation on US Air Force aircraft shall comply with Air Force Joint Manual (AFJMAN) 24-204, *Preparing Hazardous Materials for Military Air Shipment*. Transportation of chemicals on base in government or contractor-owned vehicles shall be accomplished with vehicles in good condition, appropriate tie-downs to prevent tipping and breakage, and an approved type of fire extinguisher (refer to AFOSH Standard 91-56, *Fire Protection and Prevention*). Also see AFI 24-301 and Air Force Manual (AFMAN) 24-309 (both titled Vehicle Operations) for training requirements for the vehicle operator. Appropriate hazardous material placards shall be used on the vehicle. Transporting hazardous chemicals on base in privately-owned vehicles is strictly prohibited. The user of any hazardous material should also be familiar with the requirements for turn-in to the Defense Property Disposal Office (DPDO) (refer to Department of Defense [DOD] 4260.221-M, *Defense Disposal Procedures*).

3.3. Storage. Warehouse storage shall follow the guidelines of DOD 4145.19-R-1, *Storage and Warehousing Facilities*. Flammable liquid storage will comply with AFOSH Standard 91-43, *Flammable and Combustible Liquids*. Some chemicals must be stored separately from others to preclude violent reactions or release of toxic materials in the event of breakage. **Attachment 4** is a guide on the storage compatibility of some classes of chemicals and some specific chemicals. It should be noted that this is a representative listing and is not intended to be all encompassing. Bioenvironmental engineering (BE) and fire department officials will be consulted before potentially incompatible chemicals are stored with each other. Chemical storage in (or near) the workplace shall be reviewed and approved by base fire department and BE personnel. The base BE, fire department, ground safety office, and the BEC officials will evaluate the adequacy of:

3.3.1. Area controls and security and warning signs.

3.3.2. Ventilation.

3.3.3. Fire protection -- automatic suppression or detection.

3.3.4. Training -- general hazard familiarization.

3.3.5. Personal protective equipment and first aid equipment (kits -- National Stock Number [NSN] 6545-00-922-1200).

3.3.6. Chemical spill emergency measures.

3.3.7. Storage and spill containment construction features.

3.3.8. Written procedures, if applicable.

NOTE:

Consult DOD 4145.19-R-1 for procedures to be followed by an organization requesting a waiver on the storage of chemicals in areas and (or) circumstances considered less than ideal.

3.4. Handling and Use of Chemicals. All new planned chemical operations shall be preceded by a joint review by the supervisor and the base BEE. Tech data, hazardous material information, MSDS, and other BEE resources shall be carefully reviewed to properly identify the hazards and to assign necessary controls. Especially critical (and requiring BE and fire department review) are:

3.4.1. Labeling of containers — especially proper labeling of in-shop containers.

3.4.2. Ventilation.

3.4.3. Fire protection.

3.4.4. Personal protective and first aid equipment.

3.4.5. Training — general hazard familiarization.

3.4.6. Chemical spills measures.

3.4.7. Chemical disposal.

3.4.8. Written procedures.

3.5. Disposal of Chemicals. Disposal of hazardous chemicals, especially smaller quantities, is often accomplished with inadequate review. This can result in unnecessary and unexpected hazards elsewhere or an unacceptable environmental impact. The BEC, fire department, BE, and Disaster Preparedness (DP) personnel shall be consulted before any new or modified disposal operation is planned. AFI 32-7005, *Environmental Protection Committees*, are restatements of 40 CFR (Environment) requirements and provide general policy for waste operations. Local instructions or supplements to AF 32-series may also provide procedures for waste turn-in. Because disposal can result in serious injury to both the worker and the environment, careful planning and procedures are required. Because of incompatibility between many chemicals, separate storage of each waste is preferred. Wastes will only be mixed when authorized by technical data or with the approval of the BEE. Since even small quantities of certain chemicals can destroy the organisms in the base or community sewage plant, no wastes should be disposed of in the sanitary sewer without approval of the base BE and the BEC officials.

3.6. Emergency Response to Chemical Spills.

3.6.1. Each base will identify in their hazardous material emergency response plan (according to AFI 32-4002, *Hazardous Material Emergency Planning and Response Compliance*), a team to respond effectively to chemical spills. The makeup of the team may vary by command and by the need of the particular disaster or emergency. Recommended composition of the hazardous material response team are representatives of the fire department, BE or Health Physics Advisor, and the BEC. The above are experts who have a broad knowledge of the capabilities of chemical spills. Exercises will be conducted according to applicable directives.

3.6.2. All functional managers and supervisors will be alerted to the need to promptly report chemical spills to allow prompt control by the chemical spill team. In all responses, priority is given first to life saving and injury treatment and then spill control.

3.6.3. Protective garments and sampling techniques shall be determined by the BEE. Also refer to AFOSH Standard 91-31, *Personal Protective Equipment*.

3.7. Training. Supervisors in charge of chemical operations will be constantly alert to avoid unsafe practices. Supervisors will include, in the initial and recurring job safety training of all personnel who work with chemicals, a review of chemical hazards and controls (See AFI 91-301). Once trained, personnel will be required to follow the precautions established by training, tech data, or operating instructions (OIs).

3.8. Medical Examinations. Personnel routinely exposed to hazardous chemicals will receive periodic examinations by the base medical treatment facility following the guidelines in AFOSH Standards 48-8, *Controlling Exposures to Hazardous Materials*, 48-17, *Standardized Occupational Health Program*, and AFI 48-101, *Aerospace Medical Operations*. The frequency and extent of the examination will be determined by the base or supporting medical facility as outlined in AFOSH Standard 48-8.

3.9. Change Analysis. Any planned change in an operation involving a hazardous chemical will be given a careful review or change analysis. Changes include introduction of new people to the operation, different procedures, a substitution of chemicals, addition or elimination of engineering controls, or a change in the use of a chemical (temperature, pressure, etc.). A BEE is usually the most qualified person to initially determine if the proposed change can have hazardous consequences, but the BEE depends on supervisors for advice on impending changes to the operation. The BEE will coordinate the review with the BEC, fire department, and ground safety officials. Any changes in the potential waste stream will be coordinated with the BEC, included in the Hazardous Waste Management Plan (HWMP), and reviewed by the Environmental Protection Committee (EPC). Following any analysis, appropriate changes to local procedures will be made and all personnel involved in the operation will be briefed on the changes.

3.10. Inspections and Evaluations. Areas of chemical hazard shall receive periodic visits by BE, ground safety, fire, and environmental engineering representatives. These visits should provide supervisory assistance and enforcement of the various chemical safety requirements. Occasional visits by the combined safety, health, and environmental staff of an installation are encouraged.

3.11. Pesticides. A diverse series of chemicals are used in installation pest management programs to control insects, rodents, weeds, and other types of pests. Occupational safety requirements related to the storage, application, and disposal of pesticides are provided in AFI 32-1053, Pest Management Program. Additional guidance may be found in AFOSH Standards 91-31, 48-1, *Respiratory Protection Program*, 48-8, and 48-17.

3.12. Materials Handling.

3.12.1. Drums and Carboys. Two hazards are of concern here — back strain and splash or spillage of containers of hazardous liquids. Maximum use of material handling devices such as dollies, handtrucks, etc., should be considered. To avoid overflow, workers will allow about 10 percent ullage in the container. The base ground safety staff should be consulted for recommendations for a specific materials handling application.

3.12.2. Pumps. When large volumes of liquids need to be transferred from container to container or vat, etc., use of portable pumps should be considered. Pumps and associated hose shall be chemically compatible with the material being transferred. The BEE should advise on compatibility preferences.

3.12.3. Hand Transport of Hazardous Chemicals in Glass Containers. Hand transportation of hazardous chemicals should employ a rugged, chemically compatible secondary container. If the chemical is a poison or flammable liquid, a nonventing lid on the outer container should also be used.

3.13. Tanks and Vats. Tanks and vats shall be installed so rupture or overflow is contained or controlled through dikes, sumps, etc.

3.14. Process and Delivery Lines. Chemical pipes should be routed so ruptures will not expose workers to direct splash, vapors, mists, etc. Double (concentric) pipes should be considered where pipes must pass through inhabited areas. Pipes should be color-coded and labeled to indicate hazardous content. Pipes should be visually inspected for transfer integrity and condition on an annual basis by a qualified individual from the BCE office. Refer to American National Standards Institute (ANSI) A13.1, *Scheme for the Identification of Piping Systems*, for assistance in identification of hazardous materials conveyed in piping systems.

3.15. Valves and Connectors. Failures commonly occur at valves or connections in pipes. Therefore, periodic inspection and prompt repair of leaking components are necessary.

3.16. Siphoning and Cross-Connections. Any required siphoning of chemicals shall be accomplished using a device designed for this purpose. Under no circumstances shall mouth siphoning be employed. Inadvertent siphoning of toxic chemicals into potable water supplies may occur if hoses are used directly between drinking water systems and drums, tanks, sinks, etc., containing the toxic chemical. Any sudden pressure reduction in the water supply can result in the siphoning phenomenon if the hose is submerged in the toxic liquid. Facilities should be designed with back siphon devices or an air gap between potable water sources and sources of industrial chemicals.

3.17. Ingestion of Hazardous Materials. Food products and smoking materials shall be isolated from work areas where toxic materials are stored or used.

3.18. General Housekeeping. Poor housekeeping practices increase the risk of exposure to toxic materials. Supervisors will enforce good housekeeping practices at all times.

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Chief of Safety

Attachment 1

GLOSSARY OF REFERENCES, ABBREVIATIONS, ACRONYMS, AND TERMS

References

AFI 24-301, *Vehicle Operations*

AFI 32-1053, *Pest Management Program*

AFI 32-4002, *Hazardous Material Emergency Planning and Response Compliance*

AFI 32-7005, *Environmental Protection Committees*

AFI 48-101, *Aerospace Medical Operations*

AFI 91-201, *Explosive Safety Standards*

AFI 91-301, *Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Programs*

Air Force Joint Manual (AFJMAN) 24-204, *Preparing Hazardous Materials for Military Air Shipment*

Air Force Manual (AFMAN) 23-203, V1, *Solid Rocket/Propellants*

AFMAN 23-203, V2, *Liquid Propellants*

AFMAN 24-309, *Vehicle Operations*

Air Force Occupational Safety and Health (AFOSH) Standard 48-1, *Respiratory Protection Program*

AFOSH Standard 48-8, *Controlling Exposures to Hazardous Materials*

AFOSH Standard 48-17, *Standardized Occupational Health Program* (formerly designated as AFOSH Standard 161-17)

AFOSH Standard 91-31, *Personal Protective Equipment* (formerly designated as AFOSH Standard 127-31)

AFOSH Standard 91-38, *Hydrocarbon Fuels General*

AFOSH Standard 91-43, *Flammable and Combustible Liquids* (formerly designated as AFOSH Standard 127-43)

AFOSH Standard 91-56, *Fire Extinguishers* (formerly designated as AFOSH Standard 127-56)

AFOSH Standard 161-2, *Industrial Ventilation*

Department of Defense (DOD) 4145-19-R-1, *Storage and Warehousing Facilities*

DOD 4160.21M, *Defense Utilization and Disposal Manual*

DOD 4260.221-M, *Defense Disposal Procedures*

Department of Transportation (DOT) 49 Code of Federal Regulations (CFR) Parts 100-177, Hazardous Materials Regulations

Department of Transportation Pamphlet (DOTP) 5800.3 Hazardous Material Emergency Response Guidebook

Environmental Protection Agency (EPA) 40 Code of Federal Regulations (CFR) Subchapter D, Parts 100-149, Subchapter E, Parts 162-180, and Subchapter N, Parts 400-775, Toxic Chemicals

National Fire Protection Association (NFPA) 49, *Hazardous Chemicals Data*

NFPA 704, *Identification of the Hazards of Materials for Emergency Response*

Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910, Subchapter H, *Hazardous Materials*

OSHA 29 CFR 1910, Subchapter Z, *Toxic and Hazardous Substances*

OSHA 29 CFR 1910.106, *Flammable and Combustible Liquids*

Technical Order (TO) 42C-1-12, *Quality Control of Chemicals*

Chemical Research and Development — *Prudent Practices for Handling Hazardous Chemicals in Laboratories*, National Academy Press, Washington DC, 1981

Abbreviations and Acronyms

AFI—Air Force Instruction

AFJMAN—Air Force Joint Manual

AFMAN—Air Force Manual

AFOSH—Air Force Occupational Safety and Health

AFSC—Air Force Safety Center

ANSI—American National Standards Institute

BE—Bioenvironmental Engineering

BEE—Bioenvironmental Engineer

BEC—Base Environmental Coordinator

C—Celsius

CFR—Code of Federal Regulations

CHRIS—Chemical Hazard Response Information System

DOD—Department of Defense

DOT—Department of Transportation

DP—Disaster Preparedness

DPDO—Defense Property Disposal Office

DRU—Direct Reporting Unit

EPA—Environmental Protection Agency

EPC—Environmental Protection Committee

F—Fahrenheit

FOA—Field Operating Agency

HMIS—Hazardous Materials Information System

HQ—Headquarters

MAJCOM—Major Command

MSDS—Material Safety Data Sheet

NFPA—National Fire Protection Association

NIOSH—National Institute for Occupational Safety and Health

NSN—National Stock Number

OI—Operating Instruction

OSHA—Occupational Safety and Health Administration

PDO—Publishing Distribution Office

PPE—Personal Protective Equipment

psig—Pounds per Square Inch Gauge

UL—Underwriter's Laboratory

WWW—World-Wide Web

Terms

Aerosol—A material which is dispensed from its container as a mist, spray, or foam by a propellant under pressure. (29 CFR 1910.106)

Approved—Listed or approved by Underwriter's Laboratories (UL), Inc., Factory Mutual Engineering Corporation, The Bureau of Mines, National Institute for Occupational Safety and Health (NIOSH), The American National Standards Institute (ANSI), The National Fire Protection Association (NFPA), or other nationally recognized agencies which list, approve, test, or develop specifications for equipment to meet fire protection, health, or safety requirements. (29 CFR 1910.106) ***CAUTION:*** This term can be misleading and is often misused. Substances, equipment, and even procedures can be approved for one application, but not for another.

Closed Container—A container sealed with a lid or other closing device to prevent liquid or vapors from escaping at atmospheric temperatures and pressures. (29 CFR 1910.106)

Flammable Aerosol—An aerosol that is required to be labeled "Flammable" under the Federal Hazardous Substance Labeling Act (15 USC 1261). These aerosols are considered Class IA liquids. (29 CFR 1910.106)

Flashpoint—The minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. Flashpoints are established using several standard test methods. (29 CFR 1910.106)

Hazardous Chemical—A substance which may pose a risk to health, safety, and property when improperly handled, used, stored, transported, or disposed.

May—Indicates an acceptable or satisfactory method of accomplishment.

Pressure Vessel—A storage tank or container designed to operate at pressures above 15 pounds per

square inch gauge (psig). (29 CFR 1910.106)

Safety Can—An approved flammable liquid container of not more than 5 gallons capacity, having a spring-closing lid, spout cover, and other features designed to safely relieve internal pressure and to provide safe storage for the liquid. (29 CFR 1910.106)

Shall—Indicates a mandatory requirement.

Should—Indicates a preferred method of accomplishment.

Will—Is also used to indicate a mandatory requirement and in addition is used to express a declaration of intent, probability, or determination.

Attachment 2

DEPARTMENT OF TRANSPORTATION (DOT) HAZARDOUS MATERIALS

Table A2.1. Department of Transportation (DOT) Hazardous Materials Table.

Hazard Class	Description
Class A Explosive (See Figure A2.1.):	Any substance whose common purpose is to explode; i.e., initiate a substantial instantaneous release of gas and heat. (Examples: black powder, TNT, lead azide, mercury fulminate, nitroglycerine.)
General Hazard:	Blast, fragments.
Engineering Controls:	Remote operation and storage. Barricades.
Personal Protective Equipment:	Face protection. Torso protection.
Class B Explosive (See Figure A2.2.):	A substance whose general function is to decompose by rapid combustion rather than detonation. (Examples: rocket motors, pyrotechnics.)
General Hazard:	Fire, burns.
Engineering Controls:	Remote operation and storage. Barricades.
Personal Protective Equipment:	Face protection. Torso protection.
Class C Explosive (See Figure A2.3.):	Certain types of manufactured articles which contain class A or class B explosives, or both, as components, but in restricted quantities. (Examples: small arms ammunition, fuzes.)
General Hazard:	Moderate fire.
Engineering Controls:	N/A.
Personal Protective Equipment:	N/A.
Combustible Liquid:	A liquid having a flashpoint at or above 100 degrees Fahrenheit (F) (37.8 degrees Celsius [C]. (Example : fuel oil.)
General Hazard:	Fire, burns, explosion.
Engineering Controls:	Ventilation. Refer to AFOSH Standard 161-2, Industrial Ventilation . Controlled ignition sources.
Personal Protective Equipment:	Eye protection.

Hazard Class	Description
Corrosive Material (See Figure A2.4.):	A material that causes visible destruction or irreversible alteration in human skin tissue at the site of contact. (Examples: most mineral acids-nitric, sulfuric, hydrochloric - and caustics - sodium hydroxide.)
General Hazard:	Chemical burns to skin and mucous membranes.
Engineering Controls:	Ventilation. Refer to AFOSH Standard 161-2.
Personal Protective Equipment:	Face protection. Hand protection. Torso protection. Possible respiratory protection.
Flammable Gas (See Figure A2.5.):	A gas when in a concentration of 13 percent or less (by volume) in air forms an ignitable mixture. (Examples: hydrogen, propane, methane.)
General Hazard:	Fire, burns, explosion.
Engineering Controls:	Ventilation. Refer to AFOSH Standard 161-2. Controlled ignition sources.
Personal Protective Equipment:	Eye protection.
Flammable Liquid (See Figure A2.6.):	Any liquid having a flashpoint less than 100 degrees F (37.8 degrees C). (Examples: acetone, gasoline.)
General Hazard:	Fire, burns, explosion.
Engineering Controls:	Ventilation. Refer to AFOSH Standard 161-2. Controlled ignition sources.
Personal Protective Equipment:	Eye protection. Possible respiratory protection.
Flammable Solid (See Figure A2.7.):	Any solid material, other than which is liable to cause fire through friction, retained heat, or which can be ignited readily. Spontaneously combustible and water reactive materials are included in this class. Examples: sodium or potassium metal, phosphorus (white).
General Hazard:	Fire, burns, explosion.
Engineering Controls:	Ventilation. Refer to AFOSH Standard 161-2. Controlled ignition sources.
Personal Protective Equipment:	Eye protection. Hand protection. Face protection

Hazard Class	Description
Forbidden:	Materials which are inherently so hazardous as to preclude them from shipping via normal commerce channels. (Examples: ammonium fulminate, chloride azide.) ***NOTE***: The base BEE should be notified immediately upon discovering chemicals in this hazard class.
Irritating Material (See Figure A2.8.):	A substance which upon contact with fire or when exposed to air gives off dangerous or intensely irritating air contaminants. Examples: Mace, tear gas.)
General Hazard:	Chemical burns to skin and mucous membranes.
Engineering Controls:	Ventilation. Refer to AFOSH Standard 161-2.
Personal Protective Equipment:	Respiratory and skin protection.
Nonflammable Gas (See Figure A2.9.):	Gas which will not ignite and burn in air. (Examples: nitrogen, oxygen, helium, argon.) ***NOTE***: Although oxygen is classed as a "nonflammable gas," it will vigorously support combustion increasing the fire hazard of other materials.
General Hazard:	High pressure and oxygen displacement (asphyxiation).
Engineering Controls:	Ventilation (to prevent oxygen-deficient atmospheres). Refer to AFOSH 161-2.
Personal Protective Equipment:	Eye protection.
Other Regulated Material (ORM):	Material which may not be acutely (immediately) hazardous, but chronic exposures may cause future adverse health effects.
General Hazard:	Long-term health effects.
Engineering Controls:	Ventilation. Refer to AFOSH Standard 161-2.
Personal Protective Equipment:	Respiratory. Whole body protection.
Organic Peroxide (See Figure A2.10.):	An organic compound containing the 0-0 group and which may be considered a derivative of hydrogen peroxide where either or both hydrogen atoms have been replaced by organic groups. (Examples: benzoyl peroxide; peracetic acid.)
General Hazard:	Generally unstable compounds; ignite or explode easily.
Engineering Controls:	Ventilation. Refer to AFOSH Standard 161-2.
Personal Protective Equipment:	Face protection. Torso protection.

Hazard Class	Description
Oxidizer (See Figure A2.11.):	A substance that yields oxygen readily to stimulate combustion of organic matter. (Examples: perchlorates, permanganates, nitrates, and inorganic peroxides.)
General Hazard:	Fire and (or) explosion, heat, burns.
Engineering Controls:	Ventilation. Refer to AFOSH 161-2.
Personal Protective Equipment:	Hand protection. Face protection. Torso protection (aprons).
Poison A and B (See Figure A2.12.):	Any substance that is dangerous to life when inhaled, ingested, or absorbed through the skin.
General Hazard:	Toxic, death.
Engineering Controls:	Ventilation. Refer to AFOSH Standard 161-2. Glove boxes. Containment vessels.
Personal Protective Equipment:	Respiratory protection. Whole body protection.
Radioactive Material:	Any material which spontaneously emits ionizing radiation. (Examples: uranium, tritium, radium, thorium).
General Hazard:	Overexposure to ionizing radiation. Some radioactive materials represent a hazard only if inhaled or ingested. In these cases, the material may represent a toxic hazard as well as an internal radiation exposure hazard.
Engineering Controls:	Distance. Shielding. Enclosure.
Personal Protective Equipment:	Respiratory protection. Gloves.
NOTE:	Class V (Radiation) Signs shall have the signal word "DANGER" or "CAUTION" (as specified by ANSI Standard Z35.1, Specifications for Accident Prevention Signs) in the upper panel, and a lower panel with the radiation symbol and any additional action or emphasis wording in magenta (reddish-purple) on a yellow background. Alternatively, the radiation symbol may be displayed in the optional symbol panel as defined in ANSI Standard Z35.1, figure 1.

Figure A2.1. Class A Explosive Symbol.

-- Printing and Symbol - Black.

-- Label - Orange.

Figure A2.2. Class B Explosive Symbol.

-- Printing and Symbol - Black.

-- Label - Orange.

Figure A2.3. Class C Explosive Symbol.

-- Printing and Symbol - Black.

-- Label - Orange.

Figure A2.4. Corrosive Material Symbol.

-- Symbol - Black and White.

-- Printing - White.

-- Label - White Top Half.

-- Black Lower Half.

Figure A2.5. Flammable Gas Symbol.

-- Printing and Symbol - Black or White.

-- Label - Red.

Figure A2.6. Flammable Liquid Symbol.

-- Printing and Symbol - Black or White.

-- Label - Red.

Figure A2.7. Flammable Solid Symbol.

-- Printing and Symbol - Black. Symbol Overprinted.

-- Rectangle for Lettering - White.

-- Label - White with Verticle Red Stripes.

Figure A2.8. Irritating Material Symbol.

-- Printing - Red.

-- Label - White.

Figure A2.9. Nonflammable Gas Symbol.

-- Printing and Symbol - Black or White.

-- Label - Green.

Figure A2.10. Organic Peroxide Symbol.

-- Printing and Symbol - Black.

-- Label - Yellow.

Figure A2.11. Oxidizer Symbol.

-- Printing and Symbol - Black.

-- Label - Yellow.

Figure A2.12. Poison A and B Symbol.

-- Printing and Symbol - Black.

-- Label - White.

Attachment 3

NFPA 49
THE NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD IDENTIFICATION SYSTEM

INTRODUCTION:

The increasing use of a wide variety of chemicals, many of which introduce problems other than flammability, led to the need for a simple hazard identification system. The purpose of such a system would be to safeguard the lives of those individuals who may be concerned with fires occurring in an industrial plant or storage location.

This system provides simple, readily recognizable, and easily understood markings on containers, vehicles, boxcars, and buildings. These markings give, at a glance, a general idea of the inherent hazards of any material and the order of severity of these hazards as they relate to fire prevention, exposure, and control. *Its objectives are to provide an appropriate alerting signal and on-the-spot information to safeguard the lives of both public and private fire fighting personnel during fire emergencies.* It will also assist in planning for effective fire fighting operation and may be used by design engineers and health and safety personnel.

This system identifies the hazards of a material in terms of three categories; namely, "Health," "Flammability," and "Reactivity," and indicates the order of severity in each of these categories by five divisions ranging from "four (4)" indicating a severe hazard to "zero (0)" indicating no special hazard. The three categories were selected after studying approximately 35 inherent and environmental hazards of materials which could affect fire fighting operations. The five degrees were decided upon as necessary to give the required information. It was also felt that for such a system to be effective, it had to be relatively simple and readily understood.

While this system is basically simple in application, the hazard evaluation which is required for the precise use of the signals in a specific location will be made by experienced, technically competent persons. Their judgment will be based on factors encompassing a knowledge of the inherent hazards of different materials, including the extent of change in behavior to be anticipated under conditions of fire exposure and control.

The hazard categories and the degrees of hazard severity for each category where information was available is shown in **Figure A3.1.**. Where no numbers exist, adequate information was not available. It should be emphasized that the assignment of degrees is based on judgment and that conditions in plants or processes might change the degrees of hazard. If any users of NFPA 49 have additional information on any of the materials listed, it would be appreciated if they would send it to the NFPA.

Figure A3.1. Degrees of Hazard.

Diborane

Vinylidene Chloride

The following discussions on degrees of hazard are an interpretation of the information contained within NFPA No. 704, Identification of the Hazards of Materials for Emergency Response, and are related specifically to the fire fighting aspects. Refer to NFPA No. 704 for a detailed discussion of the identification system.

HEALTH:

In general, health hazard in fire fighting is that of a single exposure which may vary from a few seconds up to an hour. The physical exertion demanded in fire fighting or other emergency conditions may be

expected to intensify the effects of any exposure. Only hazards arising out of an inherent property of the material are considered. The following explanation is based upon protective equipment normally used by fire fighters.

4 - Materials too dangerous to health to expose fire fighters. A few whiffs of the vapor could cause death or the vapor or liquid could be fatal on penetrating the fire fighter's normal full protective clothing. The normal full protective clothing and breathing apparatus available to the average fire department will not provide adequate protection against inhalation or skin contact with these materials.

3 - Materials extremely hazardous to health, but areas may be entered with extreme care. Full protective clothing, including self-contained breathing apparatus, coat, pants, gloves, boots, and bands around legs, arms, and waist should be provided. No skin surface should be exposed.

2 - Materials hazardous to health, but areas may be entered freely with full-face-mask self-contained breathing apparatus which provides eye protection.

1 - Materials only slightly hazardous to health. It may be desirable to wear self-contained breathing apparatus.

0 - Materials which on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.

FLAMMABILITY:

Susceptibility to burning is the basis for assigning degrees within this category. The method of attacking the fire is influenced by this susceptibility factor.

4 - Very flammable gases or very volatile flammable liquids. Shut off flow and keep cooling water streams on exposed tanks or containers.

3 - Materials which can be ignited under almost all normal temperature conditions. Water may be ineffective because of the low flashpoint.

2 - Materials which must be moderately heated before ignition will occur. Water spray may be used to extinguish the fire because the material can be cooled below its flashpoint.

1 - Materials that must be preheated before ignition can occur. Water may cause frothing if it gets below the surface of the liquid and turns to steam. However, water fog gently applied to the surface will cause a frothing which will extinguish the fire.

0 - Materials that will not burn.

REACTIVITY (STABILITY):

The assignment of degrees in the reactivity category is based upon the susceptibility of materials to release energy either by themselves or in combination with water. Fire exposure was one of the factors considered along with conditions of shock and pressure.

4 - Materials which (in themselves) are readily capable of detonation or of explosive decomposition or explosive reaction at normal temperatures and pressures. Includes materials which are sensitive to

mechanical or localized thermal shock. If a chemical with this hazard rating is in an advanced or massive fire, the area should be evacuated.

3 - Materials which (in themselves) are capable of detonation or of explosive decomposition or of explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. Includes materials which are sensitive to thermal or mechanical shock at elevated temperatures and pressures or which react explosively with water without requiring heat or confinement. Fire fighting should be done from an explosion resistant location.

2 - Materials which (in themselves) are normally unstable and readily undergo violent chemical change but do not detonate. Includes materials which can undergo chemical change with rapid release of energy at normal temperatures and pressures or which can undergo violent chemical change at elevated temperatures and pressures. Also includes those materials which may react violently with water or which may form potentially explosive mixtures with water. In advanced or massive fires, fire fighting should be done from a safe distance or from a protected location.

1 - Materials which (in themselves) are normally stable but which may become unstable at elevated temperatures and pressures or which may react with water with some release of energy but not violently. Caution will be used in approaching the fire and applying water.

0 - Materials which (in themselves) are normally stable even under fire exposure conditions and which are not reactive with water. Normal fire fighting procedures may be used.

ADDITIONAL MARKINGS:

A fourth space in the identification symbol is reserved for additional information when such may be of value to the fire fighters. For example, any material which will react violently with water should carry the symbol “W” with a horizontal line through it to indicate “avoid use of water.” Radioactivity could be identified in this space as well as other special information.

Attachment 4

GUIDE TO COMPATIBILITY OF CHEMICALS

The Guide is based in part upon information provided to the Coast Guard by the National Academy of Sciences—US Coast Guard Advisory Committee on Hazardous Materials and represents the latest information available to the Coast Guard on chemical compatibility.

The accidental mixing of one chemical cargo with another can in some cases be expected to result in a vigorous and hazardous chemical reaction. The generation of toxic gases, the heating, overflow, and rupture of cargo tanks, and fire and explosion are possible consequences of such reactions.

The purpose of the Compatibility Chart (**Table A4.1.**) is to show chemical combinations believed to be dangerously reactive in the case of accidental mixing. It should be recognized, however, that the Chart provides a broad grouping of chemicals with an extensive variety of possible binary combinations. Although one group, generally speaking, can be considered dangerously reactive with another group where an "X" appears on the Chart, there may exist between the groups some combinations which would not dangerously react. The chart should therefore not be used as an infallible guide. It is offered as an aid in the safe loading of bulk chemical cargoes, with the recommendation that proper safeguards be taken to avoid accidental mixing of binary mixtures for which an "X" appears on the Chart. Proper safeguards would include consideration of such factors as avoidance of the use of common cargo and vent lines and carriage in adjacent tanks having a common bulkhead.

The following procedure explains how the Guide should be used in determining compatibility information:

Determine the reactivity group of a particular product by referring to the alphabetical list in **Table A4.2.**

For example, crotonaldehyde is listed in **Table A4.2.** as belonging in Group 19 (Aldehydes). The Chart shows that chemicals in this group should be segregated from sulfuric and nitric acids, caustics, ammonia, and all types of amines (aliphatic, alkanol, and aromatic). According to Note A, crotonaldehyde is also incompatible with nonoxidizing mineral acids.

It is recognized there are wide variations in the reaction rates of individual chemicals within the broad groupings shown reactive by the Compatibility Chart. Some individual materials in one group will react violently with some of the materials in another group and cause great hazard; others will react slowly, or not at all. Accordingly, a useful addition to the Guide would be the identification of specific binary combinations which are found not to be dangerously reactive, even though an "X" appears on the chart for those two chemicals. A few such combinations are listed in **Table A4.3.**.

CHEMICAL COMPATIBILITY CHART

The following compatibility chart was extracted from "Chemical Hazard Response Information System (CHRIS)" — Hazardous Chemical Data (GPO 050-023-00247-2) issued by the US Department of Transportation Coast Guard, October 197.

Notes to **Table A4.1.**, Chemical Compatibility Chart Reactivity Differences (Deviations) Within Chemical Groups

A Acrolein (19), Crotonaldehyde (19), and 2-Ethyl-3-propyl acrolein (19) are not compatible with Group 1, Non-Oxidizing Mineral Acids.

B Isophorone (18), and Mesityl Oxide (18) are not compatible with Group 8, Alkanolamines.

C Acrylic Acid (4) is not compatible with Group 9, Aromatic Amines.

D Allyl Alcohol (15) is not compatible with Group 12, Isocyanates.

E Furfuryl Alcohol (20) is not compatible with Group 1, Non-oxidizing Mineral Acids.

F Furfuryl Alcohol (20) is not compatible with Group 4, Organic Acids.

G Dichloroethyl Ether (36) is not compatible with Group 2, Sulfuric Acid.

H Trichloroethylene (36) is not compatible with Group 5, Caustics.

I Ethylenediarnine (7) is not compatible with Ethylene Dichloride (36).

Table A4.1. Chemical Compatibility Chart.

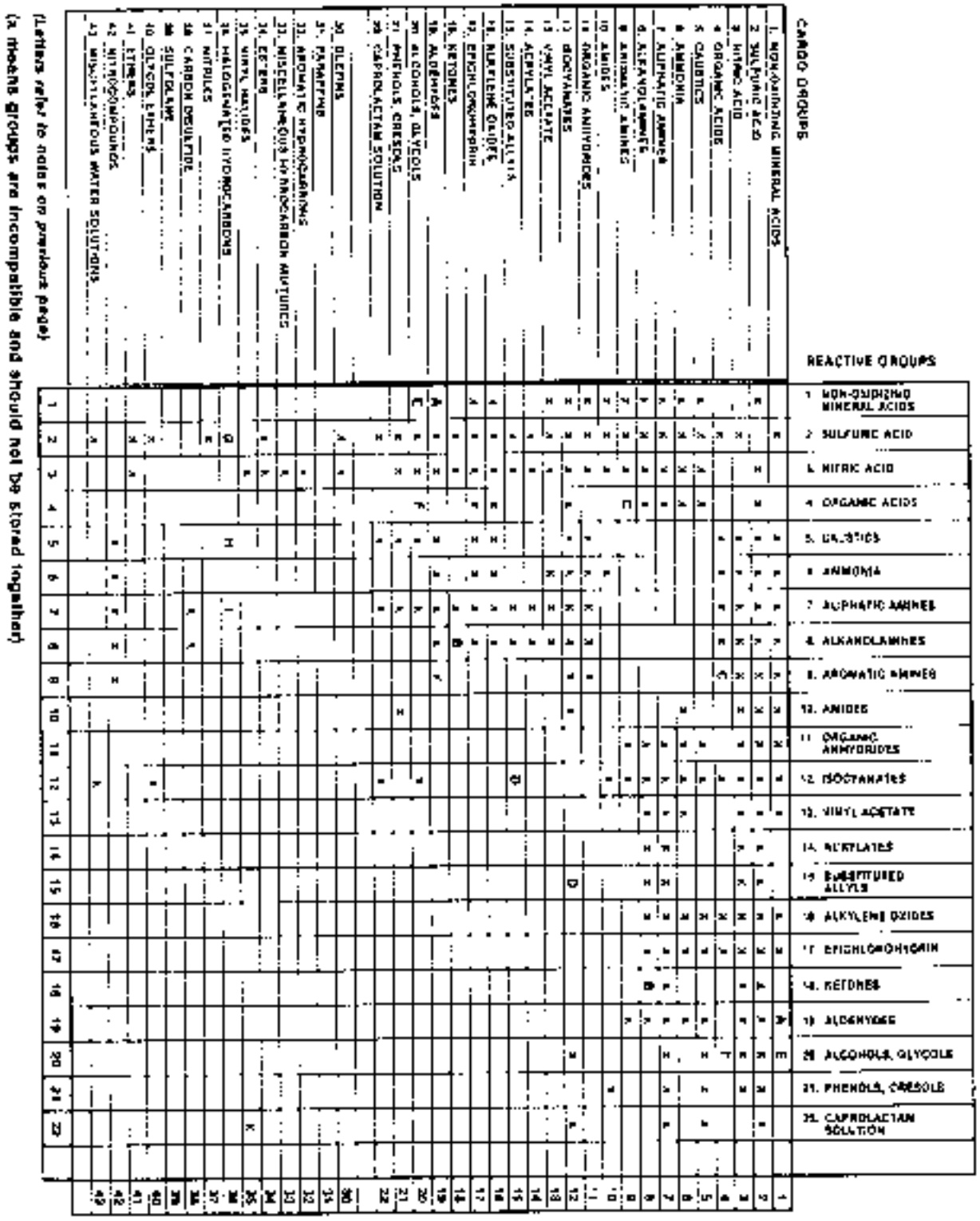

Table A4.2. Compatibility Guide.

ALPHABETICAL LISTING OF COMPOUNDS			
Name	Group No	Name	Group No.
Acetaldehyde	19	Carbolic Oil	21
Acetic Acid	4	Carbon Disulfide	38
Acetic Anhydride	11	Carbon Tetrachloride	36
Acetone	18	Caustic Potash Solution	5
Acetonitrile	37	Caustic Soda Solution	5
Acrolein (inhibited)	19	Chlorine	*
Acrylic Acid (inhibited)	4	Chlorobenzene	36
Acrylonitrile (inhibited)	15	Chloroform	36
Adiponitrile	37	Chlorosulfonic Acid	*
Allyl Alcohol	15	Corn Syrup	43
Allyl Chloride	15	Creosote, Coal Tar	21
Aminoethylethanolamine	8	Cresols	21
Ammonia, Anhydrous	6	Cresylate Spent Caustic Solution	5
Ammonium Hydroxide (28% or less)	6	Crotonaldehyde	19
Ammonium Nitrate, Urea Water Solutions (containing Ammonia)	6	Cumene	32
Ammonium Nitrate, Urea Water Solutions (not containing Ammonia)	43	Cycloaliphatic Resins	31
Amyl Acetate	34	Cyclohexane	31
Amyl Alcohol	20	Cyclohexanol	20
Amyl Tallate	34	Cyclohexanone	18
Aniline	9	Cyclohexylamine	7
Asphalt	33	Cymene	32
Asphalt Blending Stocks:			
Roofers Flux	33	Decaldehyde	19
Straight Run Residue	33	Decane	31
		Decene	30
Benzene	32	Decyl Alcohol	20
Benzene, Toluene		Decyl Acrylate (inhibited)	14
Xylene (crude)	32	Decylbenzene	32
Butadiene (inhibited)	30	Dextrose Solution	43
Butane	31	Diacetone Alcohol	20

ALPHABETICAL LISTING OF COMPOUNDS			
Name	Group No	Name	Group No.
Butyl Acrylate (inhibited)	14	Dibutylamine	7
Butyl Acetate	34	Dibutyl Phthalate	34
Butyl Alcohol	20	Dichlorobenzene	36
Butylamine	7	Dichlorodifluoromethane	36
Butyl Benzyl Phthalate	34	1,1-Dichloroethane	36
Butylene	30	Dichloroethyl Ether	41
1,3-Butylene Glycol	20	Dichloromethane	36
Butylene Oxide	16	1,1-Dichloropropane	36
Butyl Ether	41	1,2-Dichloropropane	36
Butyl Methacrylate (inhibited)	14	1,3-Dichloropropene	15
Butyraldehyde	19	Dicyclopentadiene	30
Butyric Acid	4	Diethanolamine	8
		Diethylamine	7
Camphor Oil (light)	18	Diethylbenzene	32
Caprolactam Solution	22	Diethylene Glycol	40
Diethylene Glycol Monobutyl Ether	40	Ethylene Dibromide	36
Diethylene Glycol Monobutyl Ether Acetate	34	Ethylene Dichloride	36
Diethylene Glycol Monoethyl Ether	40	Ethylene Glycol	20
Diethylene Glycol Monomethyl Ether	40	Ethylene Glycol Monobutyl Ether	40
Diethylenetriamine	7	Ethylene Glycol Monobutyl Ether Acetate	34
Diethylethanolamine	8	Ethylene Glycol Monoethyl Ether	40
Diheptyl Phthalate	34	Ethylene Glycol Monoethyl Ether Acetate	34
Diisobutylene	30	Ethylene Glycol Monomethyl Ether	40
Diisobutyl Carbinol	20	Ethylene Oxide	*
Diisobutyl Ketone	18	Ethyl Ether	41
Diisodecyl Phthalate.	34	Ethylhexaldehyde	19
Diisopropanolamine	8	2-Ethyl Hexanol	20
Diisopropylamine	7	2-Ethylhexyl Acrylate (inhibited)	14
Dimethylamine	7	Ethyl Hexyl Tallate	34
Dimethylethanolamine	8	Ethyl Methacrylate (inhibited)	14

ALPHABETICAL LISTING OF COMPOUNDS			
Name	Group No	Name	Group No.
Dimethylformamide	10	2-Ethyl-3-Propyl Acrolein	19
Dinonyl Phthalate	34		
Dioctyl Phthalate	34	Formaldehyde Solution (37-500%)	19
1,4-Dioxane	41	Formic Acid	4
Diphenyl-Diphenyl Oxide	33	Furfural	19
Diphenylmethane Diisocyanate	12	Furfuryl Alcohol	20
Di-n-propylamine	7		
Dipropylene Glycol	40	Gas Oil: Cracked	33
Distillates:		Gasoline Blending Stocks:	
Straight Run	33	Alkylates	33
Flashed Feed Stocks	33	Reformates	33
Diundecyl Phthalate	34	Gasolines:	
Dodecane	31	Casinghead (natural)	33
Dodecanol	20	Automotive (containing over 4.23 grams lead per gallon)	33
Dodecene	30	Aviation (containing not over 4.86 grams lead per gallon)	33
Dodecylbenzene	32	Polymer	33
		Straight Run	33
Epichlorohydrin	17	Glutaraldehyde Solution	19
Ethane	31	Glycerine	20
Ethanolamine	8	Glycol Diacetate	34
Ethoxylated Alcohols C11 -C15	40	Glyoxal Solution	19
Ethoxy Triglycol	40		
Ethyl Acetate	34	Heptane	31
Ethyl Alcohol	20	Hexamethyleneimine	7
Ethyl Acrylate (inhibited)	14	Hexane	31
Ethylamine	7	Hexanol	20
Ethyl Benzene	32	Hexene	30
Ethyl Butanol	20	Hexylene Glycol	20
Ethyl Chloride	36	Hydrochloric Acid	1
Ethylene	30	Hydrofluoric Acid	1
Ethylene Chlorohydrin	20		
Ethylene Cyanohydrin	20	Isophorone	18

ALPHABETICAL LISTING OF COMPOUNDS			
Name	Group No	Name	Group No.
Ethylenediamine	7	Isoprene (inhibited)	30
Jet Fuels:		Nonyl Phenol	21
JP-1 (Kerosene)	33	Nonyl Phenol (ethoxylated)	40
JP-3	33		
JP-4	33	Octane	31
JP-5 (Kerosene, Heavy)33	33	Octene	30
		Octyl Alcohol	20
Kerosene	33	Octyl Aldehyde	19
		Octyl Epoxytallate	34
Latex, Liquid Synthetic	43	Oils:	
		Clarified	33
Mesityl Oxide	18	Coal Oil	33
Methane	31	Crude Oil	33
Methyl Acetate	34	Diesel Oil	33
Methyl Acetylene, Propadiene Mixture (Stabilized)	30	Fuel Oils:	
Methyl Acrylate (inhibited)	14	No. 1 (Kerosene)	33
Methyl Alcohol	20	No. 1-D	33
Methyl Amyl Acetate	34	No. 2	33
Methyl Amyl Alcohol	20	No. 2-D	33
Methyl Bromide	36	No. 4	33
3-Methyl Butyraldehyde	19	No. 5	33
Methyl Chloride	36	No. 6	33
Methyl Ethyl Ketone	18	Residual	33
2-Methyl-5-Ethyl Pyridine	9	Road	33
Methyl Formal (Dimethyl Formal)	41	Transformer	33
Methyl Isobutyl Ketone	18	Edible Oils, including:	
Methyl Isobutyl Carbinol	20	Castor	34
Methyl Methacrylate (inhibited)	14	Coconut	34
(alpha-) Methyl Styrene (inhibit-ed)	30	Cotton Seed	34
Mineral Spirits	33	Fish	34
Monochlorodifluoromethane	36	Lard	34
Morpholine	7	Olive	34

ALPHABETICAL LISTING OF COMPOUNDS			
Name	Group No	Name	Group No.
Motor Fuel Antiknock Compounds Containing Lead Alkyls	*	Palm	34
		Peanut	34
Naphtha:		Safflower	34
Coal Tar	33	Soya Bean	34
Solvent	33	Tucum	34
Stoddard Solvent	33	Vegetable	34
Varnish Markers and Painters (75%)	33	Miscellaneous Oils, including:	
Naphthalene (molten)	32	Absorption	33
Nitric Acid (70% or less)	3	Aromatic	33
Nitric Acid (95%)	*	Coal Tar	33
Nitrobenzene	43	Heartcut Distillate	33
1- or 1-Nitropropane	43	Linseed	33
Nitrotoluene	43	Lubricating	33
Nonane	31	Mineral	33
Nonene	30	Mineral Seal	33
Nonyl Alcohol	20	Motor	33
Miscellaneous Oils, including (cont)		Pyridine	9
Neatsfoot	33	Sodium Hydrosulfide Solution (45% or less)	5
Penetrating	33	Sorbitol	20
Range	33	Styrene (inhibited)	30
Resin	33	Sulfolane	39
Resinous Petroleum	33	Sulfur (molten)	*
Rosin	33	Sulfuric Acid	2
Sperm	33	Sulfuric Acid, Spent	2
Spindle	33		
Spray	33	Tallow	34
Tall	34	Tallow Fatty Alcohol	20
Tanner's	33	1,1,2,2-Tetrachloroethane	36
Turbine	33	Tetradecanol	20
Oleum	*	Tetradecene	30
		Tetradecylbenzene	32

ALPHABETICAL LISTING OF COMPOUNDS			
Name	Group No	Name	Group No.
Pentadecanol	22	Tetraethylene Glycol	40
Pentane	31	Tetraethylenepentamine	7
Pentene	30	Tetrahydrofuran	41
Pentyl Aldehyde	19	Tetrahydronaphthalene	32
Perchloroethylene	36	Tetrasodium Salt of EDTA Solution	43
Petrolatum	33	Toluene	32
Petroleum Naphtha	33	Toluene Diisocyanate	12
Phenol	21	1,2,4 Trichlorobenzene	36
Pentachloroethane	36	Trichloroethylene	36
Phosphoric Acid	1	Tridecanol	20
Phosphorus	*	Tridecene	30
Phthalic Anhydride (molten)	11	Tridecylbenzene	32
Polybutene	30	Triethanolamine	8
Polyethylene Glycols	40	Triethylamine	7
Polymethylene Polyphenyliso-cyanate	12	Triethyl Benzene	32
Polypropylene	30	Triethylene Glycol	40
Polypropylene Glycol - Methyl Ether	40	Triethylenetetramine	7
Polypropylene Glycols	40	Tripropylene Glycol	40
Propane	31	Turpentine	30
Propanolamine	8		
Propionaldehyde	19	Undecanol	20
Propionic Acid	4	Undecene	30
Propionic Anhydride	11	Undecylbenzene	32
Propyl Acetate	34		
Propyl Alcohol	20	Valeraldehyde	19
Propylamine	7	Vinyl Acetate (inhibited)	13
Propylene	30	Vinyl Chloride (inhibited)	35
Propylene Butylene - Polymer	30	Vinylidene Chloride (inhibited)	35
Propylene Glycol	20	Vinyl Toluene (inhibited)	30
Propylene Oxide	16		
Propylene Tetramer	30	Xylene	32
Propyl Ether	41		

ALPHABETICAL LISTING OF COMPOUNDS			
Name	Group No	Name	Group No.
*Because of very high reactivity or unusual conditions of carriage, this product is not included in the Compatibility Chart. If compatibility information is needed for a shipment, contact Commandant (G-MHM-1/83), US Coast Guard, 400 Seventh Street, S.W., Washington, D.C. 20590			

REACTIVITY GROUP (These are the groups listed, using the same number, on the CHRIS Chart)	
1. Non-Oxidizing Mineral Acids	8. Alkanolamines
Hydrochloric Acid	Aminoethylethanolamine
Hydrofluoric Acid	Diethanolamine
Phosphoric Acid	Diethylethanolamine
	Diisopropanolamine
2. Sulfuric Acids	Dimethylethanolamaine
Spent Sulfuric Acid	Ethanolamine
Sulfuric Acid (98% or less)	Propanolamine
	Triethanolamine
3. Nitric Acid	
Nitric Acid (70% or less)	9. Aromatic Amines
	Aniline
4. Organic Acids	Pyridine
Acetic Acid	2-Methyl-5-Ethylpyridine
Butyric Acid	
Formic Acid	10. Amides
Propionic Acid	Dimethylformamide
Acrylic Acid (inhibited)	
	11. Organic Anhydrides
5. Caustics	Acetic Anhydride
Caustic Potash Solution	Phthalic Anhydride
Caustic Soda Solution	Propionic Anhydride
Cresylate Spent Caustic Solution	
Sodium Hydrosulfide Solution (45% or less)	12. Isocyanates
	Diphenylmethane Diisocyanate
6. Ammonia	Polyphenyl Polymethyleneisocyanate
Ammonia, Anhydrous	Toluene Diisocyanate
Ammonium Hydroxide (28% or less)	
Ammonium Nitrate, Urea, Water Solutions (containing Ammonia)	13. Vinyl Acetate

REACTIVITY GROUP (These are the groups listed, using the same number, on the CHRIS Chart)	
	Vinyl Acetate (inhibited)
7. Aliphatic Amines	
Butylamine	14. Acrylates
Cyclohexylamine	Butyl Acrylate (inhibited)
Dibutylamine	Butyl Methacrylate (inhibited)
Diethylamine	Decyl Acrylate (inhibited)
Diethylenetriamine	Ethyl Acrylate (inhibited)
Diisopropylamine	2-Ethylhexyl Acrylate (inhibited)
Dimethylamine	Ethyl Methacrylate (inhibited)
Di-n-propylamine	Methyl Acrylate (inhibited)
Ethylamine	Methyl Methacrylate (inhibited)
Ethylenediamine	
Hexamethyleneimine	15. Substituted Allyls
Methylamine	Acrylonitrile (inhibited)
Morpholine	Allyl Alcohol
Propylamine	Allyl Chloride
Tetraethylenepentamine	1,3-Dichloropropene
Triethylamine	
Triethylenetetramine	
16. Alkylene Oxides	Methanol
Propylene Oxide	Methyl Alcohol
Butylene Oxide	Methylamyl Alcohol
	Methylisobutyl Carbinol
17. Epichlorohydrin	Octyl Alcohol
Epichlorohydrin	Nonyl Alcohol
	Pentadecanol
18. Ketones	Propyl Alcohol
Acetone	Propylene Glycol
Camphor Oil	Sorbitol
Cyclohexanone	Tallow Fatty Alcohol
Diisobutyl Ketone	Tetradecanol
Isophorone	Tridecanol
Mesityl Oxide	Undecanol
Methyl Ethyl Ketone	
Methyl Isobutyl Ketone	21. Phenols and Cresols
	Carbolic Oil

REACTIVITY GROUP (These are the groups listed, using the same number, on the CHRIS Chart)	
19. Aldehydes	Creosote, Coal Tar
Acetaldehyde	Cresols
Acrolein (inhibited)	Nonyl Phenol
Butyraldehyde	Phenol
Decaldehyde	
Ethylhexaldehyde	22. Caprolactam Solution
Formaldehyde	Caprolactam Solution
Glutaraldehyde Solution	
Glyoxal Solution	23-29. Unassigned
Methylbutyraldehyde	
Octyl Aldehyde	30. Olefins
Pentyl Aldehyde	Butadiene (inhibited)
Propionaldehyde	Butene
Valeraldehyde	Butylene
	Decene
20. Alcohols, Glycols	Dicyclopentadiene
Amyl Alcohol	Diisobutylene
Butyl Alcohol	Dodecene
1,3-Butylene Glycol	Ethylene
Cyclohexanol	Hexene
Decyl Alcohol	Isoprene (inhibited)
Diacetone Alcohol	Methyl Acetylene, Propadiene Mixture (stabilized)
Diisobutyl Carbinol	(alpha-) Methyl Styrene (inhibited)
Dodecanol	Nonene
Ethanol	Octene
Ethoxylated Alcohols - C11 - C15	Pentene
Ethyl Alcohol	Polybutene
Ethylbutanol	Polypropylene
Ethylene Chlorohydrin	Propylene
Ethylene Cyanohydrin	Propylene Butylene Polymer
Ethylene Glycol	Propylene Tetramer
2-Ethyl Hexanol	Styrene (inhibited)
Furfuryl Alcohol	Vinyl Toluene (inhibited)
Glycerin	Tetradecene
Hexanol	Tridecene
Hexylene Glycol	Turpentine

REACTIVITY GROUP (These are the groups listed, using the same number, on the CHRIS Chart)	
Undecene	Oils, Residual
	Oils, Road
31. Paraffins	Oils, Transformer
Butane	Petrolatum
Cycloaliphatic Resins	Petroleum Naphtha
Cyclohexane	
Decane	34. Esters
Dodecane	Amyl Acetate
Ethane	Amyl Tallate
Heptane	Butyl Acetate
Hexane	Butyl Benzyl Phthalate
Methane	Castor Oil
Nonane	Coconut Oil
Octane	Cottonseed Oil
Pentane	Dibutyl Phthalate
Propane	Diethylene Glycol Monobutyl Ether Acetate
	Diheptyl Phthalate
32. Aromatic Hydrocarbons	Diisodecyl Phthalate
Benzene	Dinonyl Phthalate
Benzene, Toluene, Xylene (crude)	Dioctyl Phthalate
Cumene	Diundecyl Phthalate
Cymene	Ethyl Acetate
Decylbenzene	Ethylene Glycol Monobutyl Ether Acetate
Diethylbenzene	Ethylene Glycol Monoethyl Ether Acetate
Dodecylbenzene	Ethylhexyl Tallate
Ethylbenzene	Fish Oil
Naphthalene	Glycol Diacetate
Tetradecylbenzene	Lard
Tetrahydronaphthalene	Methyl Acetate
Toluene	Methyl Amyl Acetate
Tridecylbenzene	Octyl Epoxy Tallate
Triethylbenzene	Olive Oil
Undecylbenzene	Palm Oil
Xylene	Peanut Oil
	Propyl Acetate
33. Misc. Hydrocarbon Mixtures	Safflower Oil

REACTIVITY GROUP (These are the groups listed, using the same number, on the CHRIS Chart)	
Asphalt	Soybean Oil
Asphalt Blending Stocks	Tallow
Diphenyl--Diphenyl Oxide	Tucum Oil
Distillates	Vegetable Oil
Gas Oil, Cracked	
Gasoline Blending Stocks	35. Vinyl Halides
Gasolines	Vinyl Chloride (inhibited)
Jet Fuels	Vinylidene Chloride (inhibited)
Kerosene	
Mineral Spirits	36. Halogenated Hydrocarbons
Naphtha	Carbon Tetrachloride
Oils, Crude	Chlorobenzene
Oils, Diesel	Chloroform
Oils, Coal	Dichlorobenzene
Oils, Fuel (No. 1 thru No. 6)	1,1-Dichloroethane
Dichloroethyl Ether	Ethylene Glycol Monethyl Ether
Dichloromethane	Ethylene Glycol Monemethyl Ether
1,1-Dichloropropane	Nonylphenol, Ethoxylated
1,2-Dichloropropane	Polyethylene Glycols
Ethyl Chloride	Polypropylene Glycols
Ethylene Dibromide	Polypropylene Glycol Methyl Ether
Ethylene Dichloride	Soybean Oil, Epoxidized
Methyl Bromide	Tetraethylene Glycol
Methyl Chloride	Triethylene Glycol
Pentachloroethane	Tripropylene Glycol
Perchloroethylene	
1,1,2,2-Tetrachloroethane	41. Ethers
1,2,4-Trichlorobenzene	Butyl Ether
Trichloroethylene	1,4-Dioxane
	Ethyl Ether
37. Nitriles	Methyl Formal (Dimethyl Formal)
Acetonitrile	Propyl Ether
Adiponitrile	Tetrahydrofuran
38. Carbon Disulfide	42. Nitrocompounds
	(mono-) Nitrobenzene

REACTIVITY GROUP (These are the groups listed, using the same number, on the CHRIS Chart)	
39. Sulfolane	1- or 2-Nitropropane
	Nitrotoluene
40. Glycol Ethers	
Diethylene Glycol	43. Miscellaneous Water Solutions
Diethylene Glycol Monobutyl Ether	Ammonium Nitrate, Urea, Water Solutions (not containing Ammonia)
Diethylene Glycol Monoethyl Ether	Corn Syrup
Diethylene Glycol Monomethyl Ether	Dextrose Solution
Dipropylene Glycol	Latex Solutions
Ethoxy Triglycol	Tetrasodium Salt of EDTA Solution
Ethylene Glycol Monobutyl Ether	

Table A4.3. Combinations Not Dangerously Reactive.

Combinations Not Dangerously Reactive. (as tested in accordance with procedure outlined in NVC 5-70)	
Acetone (8)	Caustic soda solution (3)
Acrylonitrile (inhibited) (14)	Methyl alcohol (6)
Acrylonitrile (inhibited) (14)	Niax polyol (6)*
Acrylonitrile (inhibited) (14)	Polyol 3030 (6)*
Acrylonitrile (inhibited) (14)	Propylene glycol (6)
Acrylonitrile (inhibited) (14)	Voranol CP 4100 (6)*
Benzene (10)	Phosphoric acid (1)
Butyl acetate (n-, iso-*) (13)	Caustic soda solution (3)
Butyl acrylate (inhibited) (14)	Methyl alcohol (6)
Butyl acrylate (inhibited) (14)	Voranol CP 4100 (6)*
n-Butyl alcohol (6)	Styrene (inhibited)(14)
n-Butyl alcohol (6)	Vinyl acetate (inhibited) (14)
Carbon tetrachloride (5)	Caustic soda solution (3)
Caustic soda solution (3)	Acetone (8)
Caustic soda solution (3)	Butyl acetate (iso-*, n-) (13)
Caustics soda solution (3)	Carbon tetrachloride (6)
Caustic soda solution (3)	oils, edible: coconut (13)*
Caustic soda solution (3)	oils, edible: cottonseed (13)
Caustic soda solution (3)	Dichloropropane (5)
Caustic soda solution (3)	Dichloropropane (5)

Combinations Not Dangerously Reactive. (as tested in accordance with procedure outlined in NVC 5-70)	
Caustic soda solution (3)	Diisodecyl phthalate (13)*
Caustic soda solution (3)	Di-normal-alkyl phthalate (13)*
Caustic soda solution (3)	Dioctyl phthalate (13)
Caustic soda solution (3)	Ethyl acetate (13)
Caustic soda solution (3)	Ethylene dichloride (5)
Caustic soda solution (3)	oils, edible: fish (13)
Caustic soda solution (3)	Grease (inedible, yellow) (13)*
Caustic soda solution (3)	Lard (edible) (13)*
Caustic soda solution (3)	Linseed Oil (raw) (13)*
Caustic soda solution (3)	Methylene chloride (5)*
Caustic soda solution (3)	Methyl ethyl ketone (8)
Caustic soda solution (3)	Methyl isobutyl ketone (8)
Caustic soda solution (3)	Palm oil (13)*
Caustic soda solution (3)	Perchloroethylene (5)*
Caustic soda solution (3)	Propyl acetate (iso-*, n-) (13)
Caustic soda solution (3)	Oils, edible: soya bean (13)
Caustic soda solution (3)	Oils, miscellaneous: sperm
Caustic soda solution (3)	Styrene (inhibited) (14)
Caustic soda solution (3)	Tallow (13)
Caustic soda solution (3)	Trichloroethane (5)
Dichloropropane (5)	Caustic soda solution (3)
Dichloropropene (5)	Caustic soda solution (3)
Diisodecyl phthalate (13)*	Caustic soda solution (3)
Di-normal-alkyl phthalate(13)*	Caustic soda solution (3)
Dimethylformamide (4)	Furfural (7)
Dimethylformamide (4)	Phenol (15)
Dioctyl phthalate (13)	Caustic soda solution (3)
Dioctyl phthalate (13)	Ethylenediamine (4)
Diphenylmethanediisocyanate	Ethylene dichloride (5)
Ethyl acetate (13)	Caustic soda solution (3)
Ethyl acrylate (inhibited) (14)	Ethylene glycol (6)
Ethyl acrylate (inhibited) (14)	2-Ethyl hexanol (6)
Ethyl acrylate (inhibited) (14)	Voranol CP 4100 (6)*
Ethyl alcohol (6)	Methyl methacrylate (inhibited) (14)

Combinations Not Dangerously Reactive. (as tested in accordance with procedure outlined in NVC 5-70)	
Ethylenediamine (4)	Dioctyl phthalate (13)
Ethylene dichloride (5)	Caustic soda solution (3)
Ethylene dichloride (5)	Diphenylmethanediisocyanate
Ethylene glycol (6)	Ethyl acrylate (inhibited) (14)
Ethylene glycol (6)	Styrene (inhibited) (14)
Ethylene glycol (6)	Vinyl acetate (inhibited) (14)
2-Ethyl hexanol (6)	Ethyl acrylate (inhibited) (14)
2-Ethyl hexanol (6)	Styrene (inhibited) (14)
Furfural (7)	Dimethylformamide (4)
Furfural (7)	Isopropyl alcohol (6)
Furfural (7)	Methyl ethyl ketone (8)
Grease (inedible, yellow) (13)*	Caustic soda solution (3)
Isobutyl alcohol (6)	Styrene (inhibited) (14)
Isobutyl alcohol (6)	Vinyl acetate (inhibited) (14)
Isodecyl alcohol (6)	Vinyl acetate (inhibited) (14)
Isodecyl alcohol (6)	Methyl methacrylate (inhibited) (14)
Isooctyl alcohol (6)	Styrene (inhibited) (14)
Isooctyl alcohol (6)	Vinyl acetate (inhibited) (14)
Isopropyl alcohol (6)	Furfural (7)
Isopropyl alcohol (6	Styrene (inhibited) (14)
Isopropyl alcohol (6	Vinyl acetate (inhibited) (14)
Lard (edible) (13)*	Caustic soda solution (3)
Linseed oil (raw) (13)*	Caustic soda solution (3)
Methyl alcohol (6)	Acrylonitrile (inhibited) (14)
Methyl alcohol (6)	Butyl acrylate (inhibited) (14)
Methyl alcohol (6)	Styrene (inhibited) (14)
Methyl alcohol (6)	Vinyl acetate (inhibited) (14)
Methylene Chloride (5)*	Caustic soda solution (3)
Methyl ethyl ketone (8)	Caustic soda solution (3)
Methyl ethyl ketone (8)	Furfural (7)
Methyl isobutyl ketone (8)	Caustic soda solution (3)
Methyl methacrylate (inhibited) (14)	Ethyl alcohol (6)
Methyl methacrylate (inhibited) (14)	Isooctyl alcohol (6)
Niax polyol (6)*	Acrylonitrile (inhibited) (14)

Combinations Not Dangerously Reactive. (as tested in accordance with procedure outlined in NVC 5-70)	
Niax polyol (6)*	Vinyl acetate (inhibited) (14)
Oils, edible: coconut (13)*	Caustic soda solution (3)
Oils, edible: cottonseed (13)	Caustic soda solution (3)
Oils, edible: fish (13)	Caustic soda solution (3)
Oils, edible: soya bean (13)	Caustic soda solution (3)
Oils, miscellaneous: sperm	Caustic soda solution (3)
Palm oil (13)*	Caustic soda solution (3)
Perchloroethylene (5)*	Caustic soda solution (3)
Phenol (15)	Dimethyl formamide (4)
Phosphoric acid (1)	Benzene (10)
Phosphoric acid (1)	Toluene (10)
Phosphoric acid (1)	Xylene (10)
Polyol 3030 (6)*	Acylonitrile (inhibited) (14)
Propyl acetate (iso-*,n-) (13)	Caustic soda solution (3)
Propylene glycol (6)	Acrylonitrile (inhibited) (14)
Propylene glycol (6)	Styrene (inhibited) (14)
Styrene (inhibited) (14)	n-Butyl alcohol (6)
Styrene (inhibited) (14)	Caustic soda solution (3)
Styrene (inhibited) (14)	Ethylene glycol (6)
Styrene (inhibited) (14)	2-Ethyl hexanol (6)
Styrene (inhibited) (14)	Isobutyl alcohol (6)
Styrene (inhibited) (14)	Isooctyl alcohol (6)
Styrene (inhibited) (14)	Isopropyl alcohol (6)
Styrene (inhibited) (14)	Methyl alcohol (6)
Styrene (inhibited) (14)	Propylene glycol (6)
Styrene (inhibited) (14)	Trichloroethylene (5)
Tallow (13)	Caustic soda solution (3)
Toluene (10)	Phosphoric acid (1)
Trichloroethane (5)	Caustic soda solution (3)
Trichloroethylene (5)	Styrene (inhibited) (14)
Vinyl acetate (inhibited) (14)	n-Butyl alcohol (6)
Vinyl acetate (inhibited) (14)	Ethylene glycol (6)
Vinyl acetate (inhibited) (14)	Isobutyl alcohol (6)

Combinations Not Dangerously Reactive. (as tested in accordance with procedure outlined in NVC 5-70)	
Vinyl acetate (inhibited) (14)	Isodecyl alcohol (6)
Vinyl acetate (inhibited) (14)	Isooctyl alcohol (6)
Vinyl acetate (inhibited) (14)	Isopropyl alcohol (6)
Vinyl acetate (inhibited) (14)	Methyl alcohol (6)
Vinyl acetate (inhibited) (14)	Niax polyol (6)*
Vinyl acetate (inhibited) (14)	Voranol CP 4100 (6)*
Voranol CP 4100 (6)*	Acrylonitrile (inhibited) (14)
Voranol CP 4100 (6)*	Butyl acrylate (inhibited) (14)
Voranol CP 4100 (6)*	Ethyl acrylate (inhibited) (14)
Voranol CP 4100 (6)*	Vinyl acetate (inhibited) (14)
Xylene (10)	Phosphoric acid (1)
Toluene 2,4-diisocyanate (TDI), diphenyimethanediisocyanate (MDI), and polymethylene polyphenyl isocyanate (PAPI)* are considered compatible with reactivity groups 9, 10, 11, 12, 18, and 21.	
* Not presently included in CHRIS	

Attachment 5

CHEMICAL SAFETY CHECKLIST

This checklist is not an all-inclusive checklist. It simply highlights some critical items in this standard. Other requirements exist that are not included in the checklist. Where appropriate, MAJCOMs, DRUs, FOAs, local safety personnel, and supervisors will add to this checklist to include comomand or individual shop-unique requirements or situations.

Compatibility of Chemicals:

A5.1. Are all chemical materials ordered through normal supply channels? Is the BEE consulted prior to ordering all chemicals that have not previously been used in the shop? (Reference paragraph **3.1.**)

A5.2. Do supervisors refrain from borrowing unfamiliar chemicals from other operations without BEE coordination? (Reference paragraph **3.1.**)

A5.3. Does all commercial carrier transportation of hazardous chemicals comply with Title 49 CFR requirements? (Reference paragraph **3.2.**)

A5.4. Does all air transportation on US Air Force aircraft comply with AFJMAN 24-204? (Reference paragraph **3.2.**)

A5.5. Is transportation of chemicals on base in government or contractor-owned vehicles accomplished with vehicles in good condition, appropriate tie-downs, and an approved type of fire extinguisher? (Reference paragraph **3.2.**)

A5.6. Is the vehicle operator trained according to AFI 24-301 and AFMAN 24-309 requirements? (Reference paragraph **3.2.**)

A5.7. Are appropriate hazardous material placards used on the vehicles? (Reference paragraph **3.2.**)

A5.8. Is the transportation of hazardous chemicals on base in privately owned vehicles STRICTLY PROHIBITED? (Reference paragraph **3.2.**)

A5.9. Is the user of hazardous material familiar with the requirements for turn-in to the DPDO? (Reference paragraph **3.2.**)

A5.10. Are the guidelines of DOD 4145.19-R-1 for warehouse storage followed? (Reference paragraph **3.3.**)

A5.11. Does flammable liquid storage comply with AFOSH Standard 91-43? (Reference paragraph **3.3.**)

A5.12. Are the BE and fire department personnel consulted before potentially incompatible chemicals are stored with each other? (Reference paragraph **3.3.** and **Attachment 4**)

A5.13. Is chemical storage in (or near) the workplace reviewed and approved by the base fire department and BE representatives? (Reference paragraph **3.3.**)

A5.14. Do the BE, base fire department, ground safety office, and the BEC officials evaluate the adequacy of: (Reference paragraph **3.3.**)

- Area controls and security and warning signs?
- Ventilation?
- Fire protection — automatic suppression or detection?
- Training — general hazard familiarization?
- Personal protective and first aid equipment?
- Chemical spill emergency measures?
- Storage and spill containment construction features?
- Written procedures, if applicable? Is DOD 4145.19-R-1 consulted for procedures to be followed by an organization requesting a waiver on the storage of chemicals in areas or circumstances considered less than ideal?

A5.15. Are all new planned chemical operations preceded by a joint review by the supervisor and the base BEE? Do they carefully review tech data, hazardous material information, MSDS, and other BEE resources to properly identify the hazards and to assign necessary controls? (Reference paragraph **3.4.**)

A5.16. Do BE, ground safety, and fire department personnel review: (Reference paragraph **3.4.**)

- Labeling of containers especially proper labeling of in-shop containers?
- Ventilation?
- Fire protection?
- Personal protective and first aid equipment?
- Training — general hazard familiarization?
- Chemical spills measures?
- Chemical disposal?
- Written procedures?

A5.17. Are the BEC, fire department, BE, and DP officials consulted before any new or modified disposal operation is planned? (Reference paragraph **3.5.**)

A5.18. Are AFIs 32-4002 and 32-7005 consulted for general policy concerning waste operations? (Reference paragraph **3.5.**)

A5.19. Are wastes ONLY mixed when authorized by technical data or with the approval of the BEE? (Reference paragraph **3.5.**)

A5.20. Are wastes NOT disposed of in the sanitary sewer unless prior approval has been obtained from the base BEE and the BEC? (Reference paragraph **3.6.**)

A5.21. Is a team to respond effectively to hazardous materials spills identified in the base Hazardous Materials Emergency Response Plan (according to AFI 32-4002)? (Reference paragraph **3.6.**)

A5.22. Does the team conduct drills according to applicable directives? (Reference paragraph **3.6.**)

A5.23. Have all functional managers and supervisors been alerted to the need to promptly report chemical spills? (Reference paragraph **3.6.**)

A5.24. Is priority given first (in all responses) to life saving and injury treatment and then spill control? (Reference paragraph **3.6.**)

A5.25. Are protective garments and sampling techniques determined by the BEE? (Reference paragraph **3.6.**)

A5.26. Do supervisors in charge of chemical operations include in initial and recurring job safety training of all personnel who work with chemicals, a review of chemical hazards and controls? (Reference paragraph **3.7.**)

A5.27. Once trained, are personnel required to follow the precautions established by training, tech data, or operating instructions? (Reference paragraph **3.7.**)

A5.28. Do personnel routinely exposed to hazardous chemicals receive periodic examinations by the base medical treatment facility, following guidelines in AFOSH Standards 48-8 and 48-17 and AFI 48-101? (Reference paragraph **3.8.**)

A5.29. Is the frequency and extent of the examination determined by the base or supporting medical facility as outlined in AFOSH Standard 48-8? (Reference paragraph **3.8.**)

A5.30. Is any planned change in an operation involving a hazardous chemical given a careful review or change analysis? (Reference paragraph **3.9.**)

A5.31. Does the supervisor notify the BEE that a change is impending? (Reference paragraph **3.9.**)

A5.32. Is the review coordinated with the BEC, fire department, and ground safety officials? (Reference paragraph **3.9.**)

A5.33. Are changes in the potential waste stream coordinated with the BEC officials? Are these changes included in the HWMP and reviewed by the EPC? (Reference paragraph **3.9.**)

A5.34. Following the analysis, are appropriate changes to local procedures made and all personnel involved in the operation briefed on the changes? (Reference paragraph **3.9.**)

A5.35. Do the BE, ground safety, fire, and environmental engineering representatives periodically visit areas of chemical hazard? Do these visits provide supervisory assistance and enforcement of the various chemical safety requirements? Are these visits occasionally combined into one? (Reference paragraph **3.10.**)

A5.36. Does the supervisor refer to AFI 32-1053 and AFOSH Standards 91-31, 48-1, 48-8, and 48-17 for guidance on the use, storage, or disposal of pesticides? (Reference paragraph **3.11.**)

A5.37. Are material handling devices such as doilies, handtrucks, etc., used whenever possible when moving drums and carboys? (Reference paragraph **3.12.**)

A5.38. Is 10 percent ullage in the container allowed to avoid overflow? (Reference paragraph **3.12.**)

A5.39. Are portable pumps used whenever possible when large volumes of liquids need to be transferred from container to container, vat, etc.? Are these pumps and associated hose chemically compatible with the material being transferred? Does the BEE advise on compatibility preferences? (Reference paragraph **3.12.**)

A5.40. Do workers employ a rugged, chemically compatible secondary container whenever possible when transporting hazardous chemicals by hand? If the chemical is a poison or flammable liquid, is a nonventing lid on the outer container also used? (Reference paragraph **3.12.**)

A5.41. Are tanks and vats installed so that rupture or overflow is contained or controlled through dikes, sumps, etc.? (Reference paragraph **3.13.**)

A5.42. Are chemical pipes routed so that ruptures will not expose workers to direct splash, vapors, mists, etc.? (Reference paragraph **3.14.**)

A5.43. Are double (concentric) pipes used whenever possible where pipes must pass through inhabited areas? (Reference paragraph **3.14.**)

A5.44. Are pipes color-coded and labeled to indicate hazardous content whenever possible? (Reference paragraph **3.14.**)

A5.45. Are pipes visually inspected for transfer integrity and condition on an annual basis by a qualified individual from BCE? (Reference paragraph **3.14.**)

A5.46. Are valves and connectors periodically inspected and promptly repaired? (Reference paragraph **3.15.**)

A5.47. Is all required siphoning of chemicals accomplished using a device designed for this purpose? (Reference paragraph **3.16.**)

A5.48. Do workers abstain from mouth siphoning under any circumstances? (Reference paragraph **3.16.**)

A5.49. Are the facilities designed with back siphon devices or an air gap between potable water sources and sources of industrial chemicals? (Reference paragraph **3.16.**)

A5.50. Are food products and smoking materials isolated from work areas where toxic materials are stored or used? (Reference paragraph **3.17.**)

A5.51. Do supervisors enforce good housekeeping practices at all times? (Reference paragraph **3.18.**)